

# **IEEE C95.1 Standard:** *temperature issue*



# IEEE

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**Chairman, Technical Committee 95**

**International Committee on Electromagnetic Safety**

**Institute of Electrical and Electronics Engineers**

**Piscataway, New Jersey**

**USA**



# IEEE RF Safety Standard History

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- 1960: USASI C95 Radiation Hazards Project and Committee chartered
- 1966: USAS C95.1-1966
  - 10 mW/cm<sup>2</sup> (10 MHz to 100 GHz)
  - based on simple thermal model
- 1974: ANSI C95.1-1974 (limits for E<sup>2</sup> and H<sup>2</sup>)
- 1982: ANSI C95.1-1982 (incorporated dosimetry)
- 1991: IEEE C95.1-1991 (two tiers – reaffirmed 1997)
- 2006: IEEE C95.1-2005 published on April 19, 2006 (comprehensive revision, 250 pages, 1143 ref.)



# SC-4 FINAL Outline for Revision of C95.1-1999

## December 5, 1999

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2. Relationship of adverse effect levels to dosimetric quantities measured in the laboratory
  - a. Relationships among current density, total current, and contact area, or
  - b. Relationship of behavioral response to SAR, or
  - c. Relationship of health or a physiological function to SAR, or
  - d. Relationship of temperature increase to SAR, or
  - e. Relationship of sensory effects to SAR and current
  - f. Limitations related to knowledge of dosimetric quantities
    - i) Near vs. far-field exposures and SAR
    - ii) Spatial considerations (peak vs. whole-body average values)
    - iii) Tissue averaging mass considerations
    - iv) Localized current density



# June 8-9, 2001

## St. Paul, MN

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- ❖ Exposure Assessment and Dosimetry Questions Forming a Basis for a Technical Rationale for Revision of IEEE C95.1-1999,  
by Ric Tell
  - 23. While it would seem that a temperature based standard, for both body average and local tissues, would be more directly related to potential injury from RF fields, does the present scientific database provide sufficient support for deriving such a standard?

# June 8-9, 2001

## St. Paul, MN

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### Responses to the questions

- ❖ Anderson: Localized SAR limits are ultimately intended to protect against excessive local temperature rises, sustained over sufficient time.
- ❖ Foster: Moreover, the limits for whole body exposure seem designed to protect against excessive total thermal load to the body, whereas those for partial body exposure should probably be designed to protect against excessive local heating (local temperature rise). That would call for a different rationale for the spatial averaging limits entirely.
- ❖ Swicord: If one moves to a thermal base for local or partial body protection then one can theoretically determine the (field) limit below which it is impossible to elevate the temperature to a critical level.



# June 8-9, 2001

## St. Paul, MN

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- ❖ Dimbylow: Heating is the basis for restrictions on RF exposures. The primary limiting quantity is temperature rise. Whole body and partial body SARs have been used as surrogates for this primary quantity. However SAR is a secondary derived standard, an indicator of temperature rise. ....The SAR average over a larger mass such as 10 g will damp the changes in magnitude and position and will be easier to correlate with temperature rise.

# December 5-6, 2003

## San Antonio, TX

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- ❖ MOTION 8: Swicord moved to have the chair appoint a task group to obtain data and **develop a thermal basis for localized exposure limits**. The working group will have 6 months to present results/conclusions to SC-4 for consideration (before June 15th).

The motion was seconded by Curtis (OSHA).

- ❖ ACTION ITEM 7: “Local Exposure Task Group” is to obtain data and develop a thermal basis for localized exposure limits. (Chadwick, Dimbylow, Elder, Johnston, Meltz, Morrissey, Swicord, Ziskin – 6/15/04)



December 6, 2005

## E-mail from Vitas Anderson

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Hi C-K,

I believe the whole basis of setting exposure limits in the C95.1 standard needs a complete overhaul, which may include for instance a change to a temperature based exposure metric. One area that is in particular need of review is our process for setting safety factors.

I submitted a list of recommendations to ICNIRP, and could do the same to ICES. I'll talk to Ric about a joint submission.

Vitas



# C95.1-2005

## Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

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### ❖ Search for “SAR”

332 instances found

### ❖ Search for “temperature”

599 instances found



# January 6, 2006

## RF Gateway

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Ron Petersen (ICES Chair)

said that "there was considerable discussion at the SC-4 meeting about the rationale for the next revision, whether it should be SAR- or temperature-based."

**"Most felt that a temperature-based standard at the higher frequencies would make more sense," he noted.**

# 29 November 2007

## Irving, Texas

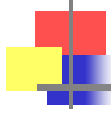
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- ❖ **Amended Motion: Move that ICES TC95/SC4 pursue the investigation of relationships between localized tissue temperature increase and peak spatial-average SAR (100 kHz to 3 GHz) or power density (3 GHz to 300 GHz) as a basis for revising a decision on the need to revise the localized exposure limits at frequencies from 100 kHz to 300 GHz.**
- ❖ The question was called and the motion was approved unanimously.



# Thermal Workshop Experts

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